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Space Science in the 1970s

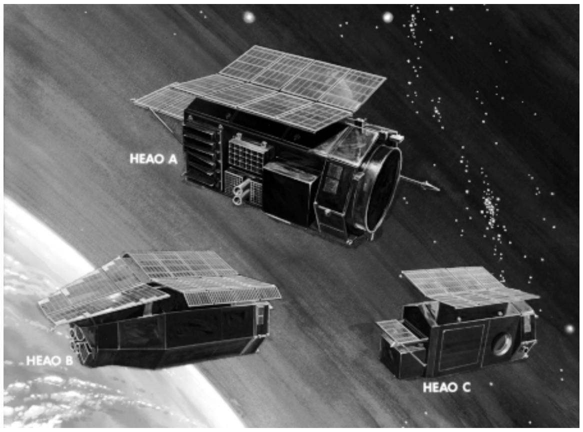
Increased scientific results from space served as the theme for the Marshall Center during the late 1970's as it moved from Saturn and *Skylab* to Space Shuttle.

Earlier Marshall missions like Project Highwater and Pegasus had demonstrated that space was a laboratory for doing science. In addition, the Apollo 14 mission in 1971 had included three Marshall-developed experiments investigating the potential for materials processing in space. That same year, closer to Earth, the Marshall Center had launched the 36-inch Stratoscope II astronomical telescope from Redstone Arsenal. Carried by a special balloon, the telescope photographed scientific targets from an operating altitude of 82,800 feet.

Again, in the last half of the l970's, the scientists at the Marshall Center used this early science as a foundation to branch into more expanded space science missions. Space would provide Marshall scientists with a global view of our planet for atmospheric observations, a microgravity environment for experiments in life sciences and materials sciences, and an opportunity to study the radiation and vacuum of space. Some of the missions were significant on their own merit. Others would serve as forerunners to more ambitious payloads in the 1980's and 1990's.

The value of space-based observatories was reinforced by the success of the High-Energy Astronomy Observatory (HEAO) series of spacecraft: HEAO–1, HEAO–2, and HEAO–3. Launched in 1977, 1978, and 1979 respectively, the three unmanned spacecraft were designed to study high-energy radiation in the universe such as x-rays, gamma rays, and cosmic rays. The Marshall Center played a major role in the project development and management, while Marshall's laboratories were heavily engaged in the technical and scientific aspects—an undertaking that included the construction of the Marshall X-Ray Calibration Facility—the largest and most sophisticated facility of its type in the world.

In 1976 Marshall launched the Laser Geodynamics Satellite (LAGEOS), which the center had conceived and manufactured in Huntsville. Basically a mirror in space, the 900-pound, 2-foot diameter satellite was designed to precisely reflect laser beams from ground stations for extremely accurate ranging measurements. This allowed the satellite to measure movements of Earth's crust. Movements of less than an inch could be detected by timing the laser beam's 3,700-mile round trip. LAGEOS was designed to serve as a ranging system for improved understanding of earthquakes, continental drift, and other geophysical phenomena.



Shown is an artist's concept of the three High-Energy Astronomy Observatory satellites launched in the late 1970s. The HEAO satellites were developed by the Marshall Space Flight Center.

Also in 1976 Marshall launched the Gravitational Redshift Probe. The purpose of the 125-pound satellite was to test the principle of equivalence in Einstein's general theory of relativity. According to theory, but never demonstrated, a clock will appear to run faster in a weaker gravitational field, at a greater distance from Earth. Scientists from Marshall and the Smithsonian Astrophysical Observatory jointly devised an ingenious experiment to test the theory. A very stable atomic clock was launched through Earth's gravitational field to a peak altitude of 6,200 miles, and its reading during the free flight was compared with that of an identical reference clock on the ground. The experiment confirmed the theory. Marshall had overall management responsibility for the construction, integration, and systems testing of the satellite.

From 1975 through 1983, Marshall conducted one of its most successful efforts involving small payloads, the Space Processing Applications Rockets project. Marshall accomplished 10 suborbital flights, which altogether carried several dozen small materials processing experiments. Intriguing results were achieved in the 5-minute periods of near weightlessness as the rocket passed through its apex.